

UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant: Ned Emidio Cipollini Art Unit: 1746
Serial No.: 10/810,796 Examiner: Phasge, Arun S.
Filed: 03/26/2004 Attorney Docket No.: 67097-020; EH-11085
Title: ELECTROCHEMICAL FUEL DEOXYGENATION SYSTEM

Commissioner for Patents
Mail Stop Appeal Brief-Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

Appellant submits this Appeal Brief pursuant to the Notice of Appeal filed 23 January 2008.

REAL PARTY IN INTEREST

The real party in interest is **UNITED TECHNOLOGIES CORPORATION**, assignee of the present invention.

RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings related to, may directly affect or may be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 1-20 are pending, rejected and appealed.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to the removal of dissolved oxygen from fuels, and more particularly to electrochemically converting the oxygen to water.

The presence of dissolved oxygen in hydrocarbon jet fuels may be objectionable because oxygen supports oxidation reactions that yield undesirable by-products. Dissolution of air in jet fuel results in an approximately 70 ppm oxygen concentration. When aerated fuel is heated between 350°F and 850°F the oxygen initiates free radical reactions of the fuel resulting in deposits commonly referred to as “coke” or “coking.” The formation of such deposits may impair the normal functioning of a fuel delivery system, either with respect to an intended heat exchange function or the efficient injection of fuel. Typically, lowering the oxygen concentration to 2 ppm is sufficient to overcome the coking problem.

The fuel system 10 for an energy conversion device according to the present invention includes a deoxygenator system 14 with an electrochemical conversion system 36 that removes oxygen from the fuel through conversion of oxygen to water.

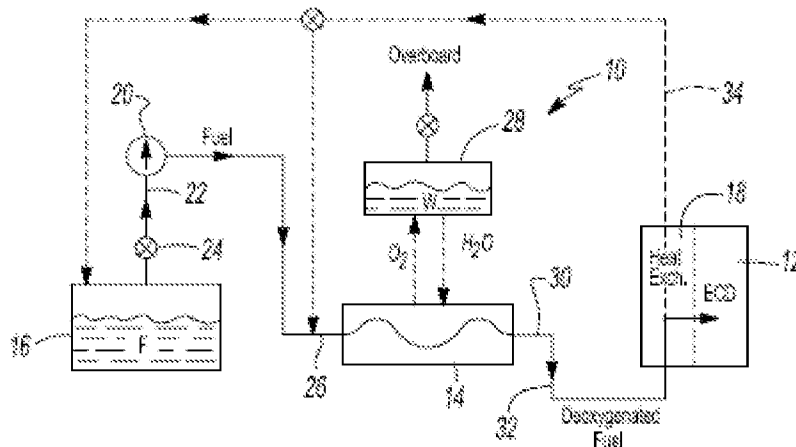


Fig-1

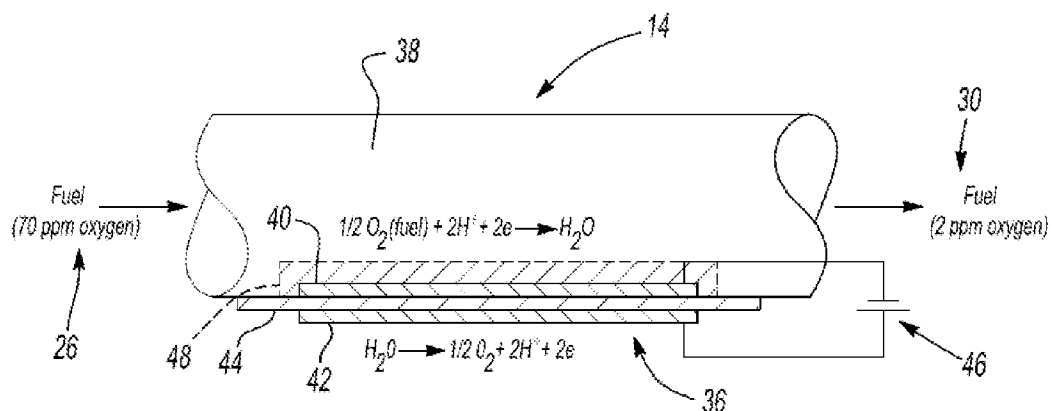


Fig-2

Summary of Claim 1

1. A fuel system 10 comprising:

an electrochemical conversion system 36 in contact with a liquid hydrocarbon fuel containing a dissolved oxygen, the electrochemical conversion system 36 operable to convert the dissolved oxygen to water and separate the water from the liquid hydrocarbon fuel. [page 4, lines 18-20; Figures 1 and 2]

Summary of Claim 7

7. A fuel system 10 comprising:

an electrochemical conversion system 36 in contact with a liquid hydrocarbon fuel containing a dissolved oxygen, the electrochemical conversion system 36 operable to convert the dissolved oxygen to water; and [page 4, lines 18-20; Figures 1 and 2]

a water collector 28 in communication with the electrochemical conversion system 36 to collect the water. [page 4, lines 6-10; Figures 1 and 2]

Summary of Claim 8

8. A method of removing dissolved oxygen from within a fuel system 10 comprising the steps of:

(1) locating an electrochemical conversion system 36 in contact with a liquid hydrocarbon fuel containing a dissolved oxygen; [page 4, lines 18-20; Figures 1 and 2]

(2) electrochemically converting the dissolved oxygen to water; and [page 4, lines 18-20; Figures 2]

(3) separating the water from the liquid hydrocarbon fuel. [page 4, lines 6-10; Figures 1 and 2]

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-20 remain rejected under 35 U.S.C. §103(a) as being unpatentable over *Reznik* (5,951,839) in view of *Spadaccini* (6,315,815) and *Isley* (3,933,638).

ARGUMENT

§103(A) REJECTIONS

The title of *Reznik* is METHOD OF PRODUCING A WATER-BASED FLUID HAVING MAGNETIC RESONANCE OF A SELECTED MATERIAL. *Reznik* discloses apparatus and methods for controlling the redox potential and the characteristics of hydrogen contained in water and to various uses of such water. [*Reznik* Col.1, lines 11-14]

In fact, *Reznik* is primarily directed to biological systems in which a water-based fluid with active hydrogen is utilized to water plants 94 or for spraying in the air so as to reduce the redox potential of an interior atmosphere of a growing enclosure. [See For Example *Reznik* Figure 7.]

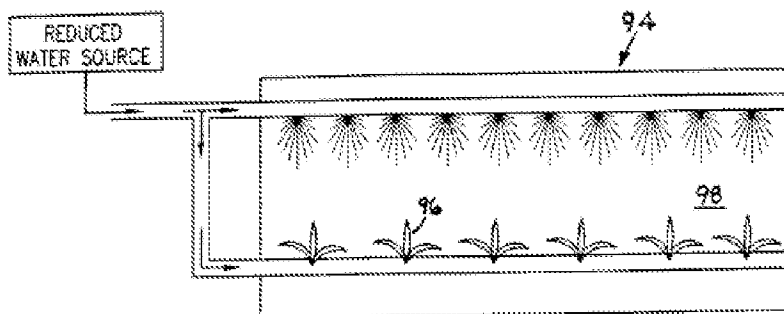


FIG. 7

The Examiner admits that *Reznik* does not disclose the mechanism by which the fuel redox potential is reduced, i.e., the combination of hydrogen with oxygen to form water.

The *Reznik* patent, while disclosing the formation of hydrogen at the cathode does not disclose the mechanism by which the fuel redox potential is reduced, i.e., the combination of hydrogen with oxygen to form water. The *Spadaccini* patent is cited to show the presence of oxygen in fuel supports oxidation reactions, i.e., the higher redox potential.

Therefore, one having ordinary skill in the art would recognize that the results obtained in the *Reznik* patent, i.e. the reduction of the redox potential would have been accomplished by a similar mechanism as recited in the present invention.

[3-23-2007 office action page 3]

The Examiner further admits that *Reznik* fails even to teach the removal of water from fuel.

The *Reznik* patent further fails to teach the removal of water from the fuel.

The *Isley* patent is cited to teach the need to remove water from fuel before use of the fuel (see claim 2).

[3-23-2007 office action page 3]

The Examiner is therefore relegated to a bold assertion of obviousness.

Consequently, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the disclosure of the Reznik patent to remove the water formed therein, because the Isley patent teaches the removal of water from fuel to obtain a purified fuel.

[3-23-2007 office action page 4]

Since *Reznik* is directed to a water-based fluid with active hydrogen, there is no reason whatsoever why a person of ordinary skill in the art of fuel systems would have combined *Spadaccini* and/or *Isley* with *Reznik* as proposed. *Spadaccini* is a membrane based fuel deoxygenator while *Isley* is a simple fuel filter. Neither secondary reference provides a water-based fluid and are not in any way concerned with biological systems. Simply, there is no motivation to combine either of *Spadaccini* or *Isley* with *Reznik*. Either failure results in defeat of the rejection. In fact, it appears that the only motivation to make the combination as proposed is by following the knowledge disclosed within Appellant's present invention. This is impermissible usage of hindsight in an attempt to recreate Appellant's device. Accordingly, the claims are properly allowable.

Example XIV of *Reznik*

The Examiner is apparently relying upon only Example XIV of *Reznik* as Example XIV is the only portion of the *Reznik* which even discloses a fuel. In the 9-24-2007 Office Action the Examiner refers to Example XIV of *Reznik* (reproduced below):

EXAMPLE XIV

Enhancement of Hydrocarbon Fuel

Hydrogen was sparged into regular unleaded gasoline. The redox potential of the gasoline was reduced from about 300 mv to -150 mv. This gasoline was employed in a lawnmower and an automobile and appeared to provide easier starting and more powerful operation.

Example XIV, however, discloses only to sparge [spray or sprinkle] hydrogen into regular unleaded gasoline in the same manner of the other examples which similarly spray water-based fluid with active hydrogen onto plants.

The Examiner argues that the lowering of the redox potential is by the formation of water (see col. 2, lines 65-67):

The present invention seeks to quench the hydroxyl free radicals by atomic hydrogen, to form water. The atomic hydrogen activity is provided via reducing water.

This citation, however, is from a completely different section of *Reznik* and has nothing whatsoever to do with Examiner XIV.

The present invention also seeks to provide apparatus and methods for reducing the redox potential of substances and various uses of such substances.

It is appreciated that drinking water, especially chlorinated water, has a high concentration of oxidizing OH radicals expressed in high redox potential readings.

The present invention seeks to quench the hydroxyl free radicals by atomic hydrogen, to form water. The atomic hydrogen activity is provided via reducing water.

[*Reznik*, Col. 2, lines 59-67]

Example XIV makes no mention of water as the water was utilized to produce the hydrogen which was then sprayed into the gasoline to provide easier starting and more powerful operation. *Reznik* requires that hydrogen be supplied:

By causing a fluid, such as a gas, e.g. air, or a liquid, e.g. water or a hydrocarbon fuel, to flow past tube 10, atomic hydrogen is supplied to the fluid, thus reducing the redox potential thereof, i.e. increasing the hydrogen activity of the fluid. Typical reductions of redox potential may be from about +300 mv to -150 mv for water, gasoline and air.

[*Reznik*, col 6, lines 49-54]

This is a more proper interpretation of the *Reznik* reference which provides a water-based fluid with active hydrogen having selected characteristics. That is, only Example XIV of the many disparate biological system examples disclosed by *Reznik* sprays or sprinkles hydrogen into unleaded gasoline, the hydrogen originally reduced from a water-based fluid with active hydrogen. This reinforces Appellant's previous argument that there is no motivation to combine either of *Spadaccini* or *Isley* with *Reznik*.

Again, the only motivation to make the combination as proposed is by following the knowledge disclosed within Appellant's invention. This is impermissible usage of hindsight in an attempt to recreate Appellant's device. Appellant respectfully requests reconsideration of the rejection.

Even if the combination were properly made – which it is not – there are differences between the claimed invention and the teachings of the cited references so that the combination does not meet the limitation of Appellant's claims.

Appellant separates water from a liquid hydrocarbon fuel through an electrochemical conversion system - said electrochemical conversion system operable to convert the dissolved oxygen to water and separate said water from said liquid hydrocarbon fuel. *Reznik* does not extract a dissolved oxygen from a fuel. *Reznik* reduces a water-based fluid to produce hydrogen – which may then be supplied to a fluid such as a gas, e.g., air, or a liquid, e.g., water or a hydrocarbon fuel. This may be more properly interpreted as opposite Appellant's invention as *Reznik* supplies a fluid hydrogen to the fuel. The secondary references fail to correct this deficiency. The proposed combination fails to disclose or suggest such subject matter and correct this failure.

CONCLUSION

For the above reasons, the rejections by the Examiner should be reversed. The Commissioner is authorized to charge the \$510 filing fee to Deposit Account No. **21-0279**. In addition, the Commissioner is authorized to charge the \$120 one month extension fee to Deposit Account No. **50-1482**.

Respectfully Submitted,

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CLAIMS APPENDIX

1. A fuel system comprising:
an electrochemical conversion system in contact with a liquid hydrocarbon fuel containing a dissolved oxygen, said electrochemical conversion system operable to convert the dissolved oxygen to water and separate said water from said liquid hydrocarbon fuel.
2. The fuel system as recited in claim 1, wherein said electrochemical conversion system comprises a first electrode in contact with the liquid hydrocarbon fuel.
3. The fuel system as recited in claim 2, wherein said first electrode is coated with a barrier material.
4. The fuel system as recited in claim 2, wherein said first electrode comprises a surface texture which generates laminar flow boundary layer mixing.
5. The fuel system as recited in claim 2, wherein said first electrode is porous and formed into conduits through which fuel passes to increase the contact area between fuel and said first electrode.
6. The fuel system as recited in claim 1 further comprising a power source to power said electrochemical conversion system.

7. fuel system comprising:
an electrochemical conversion system in contact with a liquid hydrocarbon fuel containing a dissolved oxygen, said electrochemical conversion system operable to convert the dissolved oxygen to water; and
a water collector in communication with said electrochemical conversion system to collect said water.
8. A method of removing dissolved oxygen from within a fuel system comprising the steps of:
(1) locating an electrochemical conversion system in contact with a liquid hydrocarbon fuel containing a dissolved oxygen;
(2) electrochemically converting the dissolved oxygen to water; and
(3) separating the water from the liquid hydrocarbon fuel.
9. A method as recited in claim 8, wherein said step (1) further comprises the steps of:
locating a first electrode within the liquid hydrocarbon fuel.
10. A method as recited in claim 9, further comprising the step of:
adding an oxidizable agent to the liquid hydrocarbon fuel in concentrations of about 0 to 100 ppm
11. A method as recited in claim 8, further comprising the step of:
powering the electrochemical conversion system to provide at least a 22 mV + overpotential.
12. A method as recited in claim 11, wherein said step (2) further comprises the steps of:
reducing the dissolved oxygen concentration within the fuel to below 2 ppm.

13. A method as recited in claim 8, wherein said step (1) further comprises the steps of:

locating a first electrode within a communication path of the liquid hydrocarbon fuel.

14. A method as recited in claim 8, wherein said step (1) further comprises the steps of:

locating a first electrode within a communication path of the liquid hydrocarbon fuel; and generating laminar flow boundary layer mixing with a surface geometry of the first electrode.

15. A method as recited in claim 8, wherein said step (1) further comprises the step of:

forming a concentration cell with the electrochemical conversion system.

16. A method of claim 15 further comprising the step of:
venting gas generated at the second electrode.

17. A method of claim 10 wherein said step (1) further comprises the step of:
oxidizing the oxidizable agent on the second electrode.

18. A method as recited in claim 9, further comprising the step of:
adding formaldehyde.

19. A method as recited in claim 9, further comprising the step of:
adding an alcohol.

20. A method as recited in claim 9, further comprising the step of:
adding ethylene glycol.

RELATED PROCEEDINGS APPENDIX

There are no related proceedings.

RELATED EVIDENCE APPENDIX

None.